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KIELIN,E	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/212,726	Applicant(s) Schuegraf
	Examiner Erik Kielin	Group Art Unit 2813

☒ Responsive to communication(s) filed on *Sep 25, 2000* .

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *39-48* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *39-48* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____ .

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____ .

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims **39**-42, **47**, and **48** are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Each of the independent claims (in bold above) requires "conditions which are effective to reduce the decomposition rate of the organic silicon precursor." In short, addition of H_2O or H_2O_2 tend to speed up rather than decrease the decomposition rate of the organic silicon precursor -- not reduce it.

Examiner respectfully submits that the only provision for reducing the decomposition rate provided in the specification is an *incorrect* application of Le Chatelier's Principle which can be found beginning on page 9, line 20. The information regarding the theory is incorrect for at least the following reasons: (1) The organic silicon precursor is *not in equilibrium* with the at least one of H_2O or H_2O_2 because both intermediate and product compounds of silicon are being removed from the system by deposition onto the substrate which, according to the aforementioned theory,

speeds up rather than reduces the decomposition of the precursor. (See, for example, Applicant's admitted prior art article by IslamRaja et al., page 722, last paragraph, right-hand column.) (2) There is *no reverse reaction*, so an equilibrium cannot exist. Instead, each of the organic silicon precursors claimed by Applicant can only produce H_2O by reaction of the organic portion only, the reverse reaction is thermodynamically prohibited under the conditions presented by Applicant. (3) Assuming *arguendo* that H_2O or H_2O_2 were somehow in equilibrium with the organic silicon precursor, as both a reactant and a product, H_2O or H_2O_2 would tend to cancel each other out in effect of shifting equilibrium. As more H_2O (or H_2O_2) would be produced, more reactant and product would be introduced which would tend to cancel in effect to a degree determined by the stoichiometry of the reaction. Without a specific precursor, it is impossible to determine such stoichiometry and therefore impossible to determine the alleged degree of reduction -- again assuming arguendo such equilibrium exists.

Examiner acknowledges the well known fact that H_2O (or H_2O_2) is a product of the *net* or *global* reaction in the decomposition of the organic silicon precursors (IslamRaja et al. page 722, equation (1) and paragraph thereafter) but H_2O (or H_2O_2) is **not** in equilibrium with the precursor and therefore cannot reduce the rate as alleged by Applicant in the specification. Consequently one of ordinary skill would find either *no change* in the decomposition rate or more likely an *increase* in decomposition rate of the organic silicon precursor as found, for example, by **Sukharev** (US 5,710,079; column 3, line 66 to column 4, line 13) for tetraethylorthosilicate (TEOS). Absent evidence to the contrary, the method as claimed would not operate as alleged.

Since Applicant indicates that they have observed a decrease in the rate (Remarks section of Paper No. 7, page 4, lines 9-10), **Applicant could overcome the rejection simply by providing a signed affidavit with the appropriate experimental data showing such decrease in rate in fact occurs.** This should not provide a burden since Applicant indicates that such data already exists. This evidence is necessary since the preponderance of evidence indicates that (1) Applicant's theory regarding the decomposition rate is flawed and (2) addition of water and hydrogen peroxide increase rather than decrease the decomposition rate of TEOS. See section entitled, "***Response to Arguments***" for further reasoning.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims **39**-42, **47**, and **48** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicant's claims **39**, **47**, and **48** are considered indefinite because the language "reducing the decomposition rate" is relative, but no reference point is provided so that it cannot be determined with respect to what rate the decomposition is reduced.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

6. Claims **39**-40, 42, and **43**-44 and **47** are rejected under 35 U.S.C. 102(e) as being anticipated by **Sukharev** (US 5,710,079).

Sukharev discloses a method of depositing SiO_2 on a substrate using a H_2O/H_2O_2 CVD process in which an organic silicon precursor (for example, TEOS, and others as in claim 7) and H_2O and/or H_2O_2 are fed separately into a CVD reactor (column 5, lines 55-65) in a concentration of 0.5 to 6 percent (column 7, last paragraph). The H_2O may be introduced without H_2O_2 (col. 6, ln. 55). (See also columns 3-7; Figs 2-3.)

Because the concentration range claimed by Applicant in claims 40- 42 to provide conditions "which are effective to reduce the decomposition rate" (see specification page 12, lines 3-13) overlap those in Sukharev, the method of Sukharev must inherently "reduce" the decomposition rate; although, Sukharev indicates that the rate would be increased due to the presence of H_2O/H_2O_2, as stated at the end of paragraph 2 above. *See* In re Swinhart, 169 USPQ 226,229 (CCPA 1971) (where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an

inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that subject matter shown to be in the prior art does not possess the characteristics relied on) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980) (the burden of proof can be shifted to the applicant to show that subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 USC 102 or obviousness under 35 USC 103).

Regarding claim **43**, although Sukharev does not specifically indicate that the presence of H_2O and/or H_2O_2 decreases undesired reaction intermediates, Sukharev does indicate that the growing SiO_2 film has reduced carbon resulting. It is held, absent evidence to the contrary, that because the methods are disclosed equally that the method of Sukharev will inherently reduce the presence of unwanted reaction intermediates.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev**.

The prior art as explained above discloses all of the limitations of claims **39**-40 and **43**-44 and **47**, but does not teach applicant's concentration range of 5-15%. Instead, Sukharev discloses ranges of 0.5 to 3% H_2O and 0-3% H_2O_2.

However, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim,* 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art).

Therefore, it would have been obvious to choose a concentration with Applicant's range because Sukharev discloses the overlapping range of a combination of H_2O and H_2O_2 of 0.5-6%, according to the precedent set by *In re Wertheim or In re Huang*.

9. Claims 45-46, and **48** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev** in view of **Wolf** (Silicon Processing for the VLSI Era, Vol. 1).

The prior art as explained above in paragraph 8 discloses all of the limitations of claims **39**-40 and **43**-44 and **47** except for specifically indicating that the CVD reactor is a hot wall (claim 45) or a "cold hot" reactor (claim 46) or using a hot-wall, low-pressure CVD reactor (claim 48) to deposit the silicon oxide film.

However, Wolf teaches that hot-wall, low-pressure CVD reactors are the most widely used reactors and are employed for depositing silicon oxide films because of their superior economy, throughput, uniformity, and ability to accommodate large diameter wafers on page 169, last 8 lines). Wolf also teaches the benefits of using cold wall reactors on page 171, first paragraph.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Wolf to the Sukharev reference for the reasons given by Wolf.

Response to Arguments

10. Applicant's arguments filed 9/25/00 have been fully considered but they are not persuasive.

First, Examiner notes that Applicant has not addressed Examiner's arguments concerning IslamRaja et al. and the reference, Shimogaki, therein which was cited for the reasons indicated in the office action, Paper No. 6, and repeated above -- **not for those reasons indicated by Applicant**. Shimogaki indicates that the system is **not** in equilibrium because SiO_2 is being **removed** from the system by deposition onto the surface -- such equilibrium being a well known condition for application of Le Chatelier's Principle to any reaction system. Since this is the only principle which Applicant's specification has provided to explain the basis for reduction in reaction rate and the preponderance of evidence indicates that water and hydrogen peroxide increase rather than decrease the decomposition rate, the claims are not enabled.

It also appears that Applicant has disregarded the teachings of Sukharev. Sukharev indicates that the **increase** decomposition rate of the TEOS "is due in part to the presence of an increased concentration of **hydroxyl radicals**" and that such radicals "are produced from a reaction of oxygen atoms with moisture" (i.e. water) and that "water vapor and/or hydrogen peroxide are introduced to the chemical vapor deposition reactor to ensure that a high concentration of hydroxyl radicals are present." (Emphasis added; column 2, lines 32-41.) Therefore, it is the **hydroxyl radicals -- not the atomic oxygen** as alleged by Applicant (page 5, lines 14-17 of Remarks, Paper No. 7) -- which increases the decomposition rate of TEOS; Sukharev is very clear on this point (column 3, line 66 to column 4, line 13). Accordingly **the presence of hydroxyl radicals increases the rate of decomposition of the TEOS -- especially by the addition of water and hydrogen peroxide.**

In this regard, Applicant's specification indicates that, for a hot wall reactor used in the instant invention, the temperature is about 640 C to 900 C (page 11, lines 3-6) which is known to be high enough to cause the dissociation of hydrogen peroxide into hydroxyl radicals. (See **Azuhata** et al., US 4,213,944, column 2, lines 42-43 who teaches that it is known that H_2O_2 dissociates above 400 C into **hydroxyl radicals**.) Therefore, **Applicant's reaction mixture will necessarily have hydroxyl radicals.**

Also, Applicant's specification also indicates for a cold wall reactor that the temperature is "400 C with an **rf plasma** power at 600 W" and that $\mathbf{O_2}$ is present (page 11, lines 13-16). It is well known that plasmas produce atomic oxygen which would, just a Sukharev's atomic oxygen,

produce hydroxyl radicals by reaction with water. See, for example, **Fujimura** et al. (US 5,773,201; column 3, lines 46-59) and **Konno** et al. (US 5,397,432; column 7, lines 23-35) both of which teach that water and oxygen mixtures in a plasma produce **hydroxyl radicals**. Again, **Applicant's reaction mixture will necessarily have hydroxyl radicals**.

Further in this regard, Applicant's reference to the recent article by J. Zabicky and H. Realpe, is **not relevant unless** the Zabicky and Realpe **method is carried out in a plasma**. **Since the article has not been provided**, Examiner cannot evaluate its relevance.

In short, Applicant's reaction conditions would necessarily have decomposition rate-increasing hydroxyl radicals, absent evidence to the contrary, and the claims are not enables and anticipated by Sukharev.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached on (703) 308-2417. The fax phone number for the group is (703) 308-7382.

EK

EK

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October 26, 2000